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ABSTRACT

This report addresses some of the concerns surrounding smaller classes and looks at whether reduced class sizes result in higher achievement levels, and concludes that it in fact does increase student achievement, so long as classes do not exceed 17 students. But many critics question whether the high cost of reducing classes to 17 or fewer students justifies the results. Achievement and cost-efficient comparison are then made between small classes, a combination of methods such as one-to-one tutoring by certified teacher, peer tutoring, and cooperative learning. States, such as California, that have witnessed a decline in student scores, when compared to other states, are eager to implement changes to stop the slide in academic achievement. Research has shown that decreasing class sizes is not the most efficient way of improving achievement, but all approaches have cost implications. (RJM)

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Class Size, Academic Achievement and Public Policy

Suzanne Ziegler

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Class Size, Academic Achievement, and Public Policy

Introduction

The organization of formal schooling is, and has been since the inception of public or mass education, a compromise. Providing free education to all children and young persons, whether to age 10 or 12 or 16 or 18 or through the baccalaureate degree, has always entailed the provision of one teacher to a group of learners. One-on-one tuition, which both intuitively and experimentally shows itself to be the most efficient form of schooling, achievement-wise, has never been a possibility except for the wealthy, or those schooled at home by (unpaid) parents.

What is unavoidable is also seen as desirable, for social ends. That is, most adults view the socialization aspect of schooling, which occurs only because children are educated in groups, not individually, as important and valuable. School is seen as not only an academic but also a social necessity, never more than in contemporary, highly diverse and increasingly inclusive societies.

At the same time that economics as well as social desirability dictate that children should be schooled in groups, most adults, and certainly most parents and teachers, view a relatively small group as more desirable than larger groups. The not-so-far off days when children were educated 40 or 50 or more to a room, across an age range of perhaps eight or nine years, are not looked back upon with nostalgia by educators or laypeople, much though they may admire the competence and fortitude of the teachers of yesteryear. In virtually all developed countries, the idealized classroom contains closer to 20 than to 30 or 35 students. This is true for all age levels, though the greatest difference between the ideal and the actual usually occurs at the younger (elementary) ages, to the consternation of educators as well as parents.

Parents are interested in smaller classes because they believe their children will benefit from more individual teacher attention and awareness, and that this benefit will translate into cognitive gains which will be evidenced both by the parents, experientially, and by higher scores on achievement tests.

Teachers want smaller classes for the same reasons as parents: because they too believe that, as teachers, they can be more effective for fewer students. As well, smaller classes provide more favourable working conditions for teachers: they have fewer students to monitor, fewer pieces of work to evaluate, fewer report cards and parent conferences to prepare, and presumably more manageable classes, with (absolutely, not relatively) fewer disruptive or unmotivated children.

But smaller classes are much more expensive than larger ones, and so the desire for small classes, widespread though it is, is counterbalanced by the high public cost of provision. Some estimates of the cost of lowering class size by one student include: one million pounds to include all classes in one Local Education Association (LEA) in England (see Blatchford and Mortimore, 1994, p.421); and $488 million to lower class size to 20 in kindergarten through grade 3 in the state of California (*San Francisco Chronicle*, Jan. 26, 1997, p. B-12).

As a result, for the last many decades educators have debated the value of decreasing class size and consequently increasing per pupil costs, in terms of measurable increases in academic achievement, the ultimate justification for any educational innovation or change — especially an expensive one. While other desirable ends may also be invoked and examined — such as positive changes in students' attitudes to learning, or higher retention of teachers — it is always anticipated increases in student achievement which are the rationale for investing in more teachers for fewer students.

The research question is: does it work? Do smaller classes result in higher achievement levels? And if so, how well? How sizeable are the gains?

The Research Record

The modern history of research on the connection between class size and student achievement stretches over the last twenty years, and continues to be as current as this morning's newspaper. During this time, opinion has been shaped by attempts to summarize findings in comprehensive reviews of existing studies (e.g., Glass et al, 1972; Educational Research Service, 1978; Slavin, 1989, 1990; Odden, 1990; Tomlinson, 1990; Blatchford & Mortimore, 1994), as well as by empirical investigations which experimentally manipulate class size to answer the basic questions about its effects (Shapson et al, 1980; Word et al, 1990).

What is interesting about the results is first, the extent to which they are consistent across time, place, and methodology; and second, the extent to which researchers and other writers disagree about the meaning of these consistent findings.

First, the findings. Research carried out in classrooms in Toronto in the late 70s (see Shapson et al, 1980) and in Tennessee in the 80s and 90s (Finn and Achilles, 1990; Mosteller, 1995; Word et al, 1990) did what few studies had done earlier. In both cases, students were randomly assigned to classes of differing sizes in the same schools, and their achievement in core subjects was tested on standardized measures and compared after two or more years in the different classes. The Tennessee study was much larger than the Toronto one, but both are landmark studies, and both came to the same conclusion: *decreasing class size does not affect students' measured achievement unless and until class size is less than 20 students.* (In the Toronto study, the small classes had 16 students; in Tennessee, they ranged betweeen 13 and 17.)

These and almost all other studies of class size were done in the elementary grades. The Tennessee study involved thousands of children in kindergarten and grades one, two and three. The Toronto study involved grades four and five students. In Toronto, the small classes of 16 students were compared to class sizes of 23, 30, and 37. Only the classes of 16 students showed an increase in achievement; there was no advantage for classes of 23 or 30 over classes of 37. In Tennessee, the comparisons were between classes of 13-17 and classes of 22-25 (a case where the "large" classes would look small in many states and provinces). The Tennessee experiment also included some classes of 22 to 25 which had a teacher's aide. The effect of the aide differed at different grade levels, but was, overall, not very significant. Average achievement levels were higher in the smaller classes (which had no aides).

Thus, the answer to our first question, does lowering class size increase student achievement is yes, so long as classes do not exceed 17 students.

Second, the meaning of the findings. While the differences in achievement in favour of the small classes as measured on achievement tests in reading and mathematics are statistically significant, sharp disagreement is found in the literature on whether the improvements evidenced in classes of 17 or fewer students are significant in the lay sense: that is, whether the amount of achievement gain produced by the small classes is substantial, and whether the benefit is in proportion to the cost, or whether there are other interventions which give a better return on the education dollar.

Interpreting the Findings

When measurement experts talk about the effects of a particular program or delivery method (such as class size) they speak of "effect size." This is a statistical measure of the value added by the particular change being studied. In the case of class size, studies find an effect size of about .17.

What does such a number mean? What does it tell us about the effectiveness and efficiency of lowering class size to 17 or fewer, with respect to increasing student achievement?

The best way to understand this number, is to look at it in two ways. First, by how much does a student's

achievement test score increase, if s/he is in a small (17 or under) class? Second, how much difference does the small class make compared to other changes that could be made, for the same or less cost?

In the Tennessee study, the largest improvement was found for students in grade 1 (in the kindergarten to grade 3 continuum). In reading, at the end of first grade, students' average score on the standardized test used (the Stanford Early School Achievement Test) rose from the 53 percentile for students in the classes of 22-25 to the 64 percentile for small classes (13-17 students). In mathematics, the gain was similar: from the 48th to the 59th percentile, on average, from the larger to the smaller classes. While any parent would be pleased to see their child's test scores improve by 11%, it is still difficult to decide whether this degree of improvement is large enough to merit the very substantial increase in cost associated with it.

Whether or not it is significant in a practical sense is debated. The researchers associated with the Tennessee study are convinced by their results that

> This research leaves no doubt that small classes have an advantage over larger classes in reading and mathematics in the early primary grades. This experiment yields an unambiguous answer to the question of the existence of class-size effect . . . (See Word et al, 1990, p.14.)

On the other hand, reviewers unconnected with a particular experiment, who look at the Tennessee data along with that from Toronto and various other studies conclude that

> Studies of the achievement effects of substantial reductions in class size indicate that smaller classes do have more positive effects than large ones, but the effects are small to moderate in size . . . (Slavin, 1990, p.9)

> Statewide class-size reduction would have little effect on student performance and even if it did, it would cost too much money . . . (Odden, 1990, p.224)

Perhaps a fair interpretation of these differing degrees of enthusiasm is something like the following: if classes in kindergarten through grade 3 are reduced in size to 17 or fewer students, those students would show, on average, small to moderate increases in reading comprehension and mathematics test scores. (And the gains are smaller in grades 2 and 3 than in Grade 1.) Assuming that, after grade 3, class sizes increased to 20 or more, the early advantage of those students over others would gradually diminish, though they might, four years later, still show somewhat elevated test scores. (A follow-through study in Tennessee looked at whether benefits gained by students in small classes were maintained after the completion of the study when they returned to regular size classes. They were followed for three additional years. They continued to outperform the other students, but by a varying and sometimes much smaller increment.)

Is the cost of reducing classes to 17 or fewer students justified by the results? First, it is unlikely that many jurisdictions can fund and maintain funding over time for classes that small, even in kindergarten through grade 3, which is where they are generally agreed to be most desirable and beneficial. Even in Tennessee, the small classes were experimental only, and are being maintained in only the seventeen least affluent districts in the state — not in all 139 districts.

The Tennessee results may be taken to support the idea of using monies to decrease class size in particular cases. The effects of the experiment in Tennessee were appreciably stronger for minority (mainly Afro-American) students than for students overall in the first two years of the study, though not thereafter. Insofar as minority students are concentrated in particular schools, targeting those schools for smaller classes in the early years may make sense. In fact, Tennessee has chosen to institute the small classes in the early grades in the 17 school districts with the lowest per capita income, and early reports show positive but small effect sizes (Mosteller, Light and Sachs, 1996, p. 816).

But to really answer the cost/benefit question about class size, one has to ask how academically effective and cost-efficient small classes are compared to other kinds of interventions.

Alternative Ways of Increasing Academic Achievement

Strong arguments have been made for alternative interventions as superior and/or more cost-effective ways of increasing student achievement. In particular, Slavin (1989, 1990), Odden (1990), and others have argued that, since much the strongest effects have been found for "class" sizes of one to three, a far more cost effective use of additional teachers is not to reduce class size to 20 or even 17, but instead to provide tutoring situations for individual children who most need assistance.

Research which looks at the effect of one-to-one tutoring by certified teachers of the lowest achieving (or highest risk) students in grades 1 and 2 finds improvements in reading which are two to four times greater than the average effect of reducing classes to 17 or fewer students, or an effect size of .55 to 1.0, compared to the effect size of .20 or less for class size reduction under 20 students (Slavin, 1990, p.9). (Paraprofessionals are also effective as reading tutors, but not as effective as trained teachers.) Thus, instead of hiring a teacher to reduce a class of 34 to two classes of 17, the same teacher could provide individual tuition to about 15 of the lowest-achieving students in the class (or school) for 20 minutes everyday, with much greater payoff in increasing the achievement of those at the bottom level. The students who do need the extra attention apparently get more of it and are able to use it to better effect when it is delivered one on one, or perhaps in groups of not more than two or three.

(It is worth noting that the same arguments apply to remedial efforts as well as to whole class interventions: remedial groups of more than three [and eight is most typical now] are of very limited value in helping students to catch up with their peers.)

Other strategies which actually produce larger effects than halving class size and whose costs are extremely low by comparison include peer tutoring and cooperative learning (See Levin et al, 1984; Slavin, 1990.)

In addition to individual or very small group tutoring, there is evidence that groups of students which do not exceed 15 are very helpful for reading instruction in kindergarten through grade 3 when the groups are ability grouped across grades (as occurs naturally in multigrade primary classes). This kind of grouping, for a period of time each day, can be achieved without additional teaching staff. Some researchers suggest that each of these strategies — individual tutoring, cross-age reading groups, peer tutoring, and cooperative learning — can increase achievement by one half to a full standard deviation, such that improvement from the combined techniques (which admittedly require significant investment in staff development for effective implementation) would be dramatic indeed. (Odden, 1990, p.225)

The Persistence of Interest in Lowering Class Size

The research on class size is now quite strong, given the size and scope of the Tennessee study, and it is surprisingly consistent: class sizes above 17 do not result in significant increases in measurable student achievement. *Class sizes of 17 or fewer do improve achievement, but by amounts which seem modest in relation to their cost and in relation to other alternatives.* Furthermore, while no one suggests that such small classes are realistic across entire jurisdictions and all eight or nine years of elementary school, the evidence is so far lacking to show that the gains garnered in two or three years are robust or permanent. (The one kind of intervention that appears to have truly lasting and remarkable effects is intensive early childhood education/preschool, especially when it includes a strong parent involvement component. By far the best-known and best-researched of these programs is the Perry Preschool. (See Barnett, 1985; Karweit, 1987.)

The reasons why much smaller classes do not make a greater difference in achievement are debatable. The most commonly offered explanation is that, in spite of teachers' intentions and beliefs to the contrary, actual teaching methodology is virtually unchanged from large to small classes, with the result that students do not actually receive much more individual attention, in a class of 20 compared to a class of 35. (This may also help to explain why cooperative grouping is effective: in effect, teachers deal with students in sufficiently small groups that each student has a better chance of getting some individual attention from her teacher, in addition to the individual assistance she may get from other group members. In effect, there is a built-in opportunity for both teacher and peer tutoring, in that situation.) Apparently, in the absence of changed teaching techniques, class size by itself is not a factor in student achievement unless and until classes are smaller than 20.

But lowering class size continues to be a very popular intervention. There are several explanations for this. Parents are generally very eager to have their children in small classes, believing that disruptions will be minimized and individual attention maximized. Indeed, smaller classes are one of the main drawing cards of private schools. Teachers are equally committed to small classes, both because they believe this will benefit students academically and because their work setting and working conditions are significantly improved when they have fewer children to supervise. There is no question that parent support and teacher morale improve when classes are made smaller. Taxpayers, too, support the idea of smaller classes, and often are willing to support increases in funding to the schools when they can see the direct result in smaller classes.

A case can certainly be made for being responsive to parents', teachers', and taxpayers' wishes. It is not uncommon, nor is it illogical or inappropriate, for teachers to negotiate class size as a condition of work. Teacher morale certainly is positively affected by smaller classes, and other monies (for new or better buildings, for example) are spent to improve school tone and morale without requiring justification in higher test scores. Lacking data, we cannot know but might expect that smaller classes might result in higher teacher retention, and a lower absence rate. Students may enjoy school more, and may improve their attendance and attitude. Thus, there are certainly arguments to be made for lowering class size that are independent of the achievement issue.

But the fact is that when class sizes are lowered, it is virtually always in the name of improving student achievement, which is generally perceived as the only justification of such an expensive public intervention. A typical case currently is the State of California, where the governor has decreed and the state is underwriting classes not to exceed 20 students in kindergarten through grade 3. The impetus: a steep decline in comparative test scores, such that California has fallen below many other states it formerly excelled, as indicated on standardized reading and arithmetic tests. And herein may lie another reason for the persistence of attempts to raise achievement by lowering class size: published scores in tables comparing achievement by school or district or province or state are susceptible to impressive-looking changes in position as a result of relatively small changes at the individual student level. What may be only an average of a few points or percentile increase on a standardized test score at the individual level may be enough, state-wide, to raise the position of that state from a very low one to a median one, or from the median to a relatively high one. In terms of public pride, or political consequences to elected officials, such a change may be very promising. In the 17 poorest Tennessee school districts where the small classes have been institutionalized, for example, the gain and effect size is a mere .04 to .06; but this fairly trivial change has meant that the districts now score above instead of far below average for the state. The academic payoff is small, but the political one may be large. (The typical unintended consequences of large-scale legislated changes in class size were also evident in California in 1997: severe classroom space shortages, and equally severe shortages of qualified teachers, resulted in paraprofessionals or uncredentialed teachers being recruited in large numbers, which in turn led to

labour unrest as teachers' unions battled against having such personnel counted as teachers in teacher-pupil ratio calculations.)

For educators and parents however, who may have to choose between what looks or feels best and what actually has the greatest impact on the achievement of the highest risk students, diminishing class size — especially in the most typical situation where the "small" classes will still exceed 17 — is a high-cost, low-return investment.

Some educators have urged that governments set policies establishing that educational changes which require or result in significant changes in how funds are used must be made based on a menu of practices proven to be effective in increasing achievement and promoting learning. Short of such measures, it is likely that parents and teachers will continue to press for smaller classes, even when such classes (shrunk to 20 or a few more) are highly unlikely to demonstrably benefit students academically. It is equally likely that they will continue to be far less aware of, and interested in, the alternatives, including individual and small group tutoring, which show greater payoff. The intuitive appeal of smaller classes — even just a little smaller — has so far proved well-nigh irresistible in spite of decades of consistent empirical findings to the contrary.

The lack of research support for decreasing class sizes to the "moderate" range (20-25, for example) has been used in some cases as prime evidence that increasing funding cannot help increase achievement. This is clearly not a logical argument. Because one strategy which depends on more funding is not very effective one cannot conclude that there is no way to improve academic outcomes by increasing funding, or that per pupil costs are unrelated to quality of schooling. That is a different debate. Decreasing class size is not the most efficient way of improving achievement; but more efficient ones also have cost implications, ranging from modest to high, and if several are combined (as would appear to be optimal) the cost implications are certainly very substantial.

As with so many issues in education, the ultimate answers lie in values, not data. Research can clarify benefits and costs; and it has done so very clearly and consistently as far as class size questions are concerned. Very small class sizes improve achievement; moderate decreases in class size do not. Very small classes are not the most cost-effective way of increasing achievement levels. The larger questions about how much of a national or provincial budget is appropriately dedicated to education can only be answered by voters and the governments they elect.

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